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Development of Computer Aids for Tape-Control of Photocomposing Machines: Implementation, Hardware, and Other Systems. Final Report, Section C.

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The work which a number of organizations have been doing on computer-processed tape composition is described in this report. As yet, no one of them has succeeded in preparing a system which completely solves the problem of mathematical composition. The state of the art is defined with reports on Input, Master Files, Production of Galley Proof, and Composition that in each case indicate which part of the system can be used, or why a particular system should not be used. A bibliography is included. (GO)

AMERICAN MATHEMATICAL SOCIETY

DEVELOPMENT OF COMPUTER AIDS FOR TAPE-CONTROL OF PHOTOCOMPOSING MACHINES

Final Report, Section C

Implementation, hardware, and other systems

January 1969

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INTRODUCTION

A number of organizations have been working on computer-processed tape composition, although no one has as yet succeeded in preparing a system which completely solves the problem for mathematical composition. Work done by some organizations is described in this part of the report.

The systems described will relate to one or more of the following parts of the system: input, master files, production of galley proof, composition, information retrieval. In each case we will either point out what part of the system can be used, or give reasons for not using this particular system.

Work on the project was done by Dr. Gordon L. Walker of the American Mathematical Society, and by Mr. Samuel B. Whidden and Miss Margaret E. Kellar of the Information Systems Development Department of the American Mathematical Society. Other investigations were made by Mr. Lawrence F. Buckland, Mr. William R. Nugent, and Mr. Richard J. McQuillin of the Staff of Inforonics, Inc.

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I. THE ALPHANUMERIC SYSTEM

Alphanumeric Incorporated offers a high-speed cathode ray tube typesetter on a service bureau basis. The output maximum is 18 point characters on a 50 pica line. The output is on film in continuous rolls. The maximum page length is 7 feet.

The speed of the system is variable, depending on the size of character and quality of characters. In proof mode, the device can compose a typical page of 10 point type in about two seconds. In final copy mode, it takes about six seconds. The cost is about $3. 00 per proof page.

The system is made up of two principal units: the computer system and the photocomposition system. The computer system is an IBM 360 used to prepare input for the photocomposition system. The computer has two broad functions: 1) It formats the information into character codes and control codes and 2) it contains in its memory the character matrices that describe the characters to the photocomposer. The photocomposer consists of a Digital Equipment Corporation PDP-8 computer driving the actual photocomposition device. The magnetic tape generated by the IBM 360 is read by the PDP-8 and interpreted into control commands for the photographic device. The actual library of character matrices are stored in the 360 and only delivered when necessary to the small memory of the PDP-8.

I. 1. The input language. The customer is asked to supply the input on magnetic tape, in the language specified by Alphanumeric. If the input is in another machine-readable form, it is possible to program conversion procedures which transform into the Alphanumeric language.

I. 2. Character fonts. Alphanumeric has a font library containing about 3, 000 standard characters. This library is growing continuously. The display of a character on the cathode ray tube is controlled from a matrix representation of the character. This matrix representation consists of a number of vertical vectors that, when displayed, make up the character. These vectors, in practice, are keypunched into cards, which are then read into the IBM-360 to make up the font libraries. A 9-point character would require some 90 vertical vectors, on the average.

Alphanumeric has expressed an interest in using the art-work which we develop for special mathematical symbols and foreign language fonts.

Remarks. Alphanumeric is a printing service and they have stated that they are not interested in maintaining master files. Therefore, master files will have to be maintained elsewhere and the material to be printed selected and ordered before the tape is sent to Alphanumeric.

At the present time, Alphanumeric does not have its program for mathematical typesetting completed, and it does not have all of the characters needed for setting mathematics. They do intend to do the necessary programming, including the programming for the characters. When this is completed, it appears that it will be a very desirable typesetting device, and the necessary translation program from our master file tapes to the Alphanumeric language should be written.

The special proof mode, which will give galley proofs at a cost less than that required for the final camera copy is a desirable feature.

II. CATHODE RAY TUBE APPLICATIONS

A possible method of producing galley proof would be to use a cathode ray tube on line or off line to the computer. A camera system would be focused on the face of the cathode ray tube, and 33mm film produced. This would be developed and enlarged to produce 10 point type size. There are at least two cathode ray tube devices of interest: The Digital Equipment Corporation Type 30 and Type 340 and the Tektronix Type 611.

The DEC Type 30 and 340 will display 1024 points across a screen of approximately 9.25 inches. This gives a maximum of 112 lines per inch. The Type 30, in fact, will display only 56 lines per inch. The usual method of displaying a character is to consider a 5 x 7 dot pattern. Characters are displayed by intensifying certain of these dots. When the display is controlled by software, larger dot patterns are available, and in practice it is possible to differentiate between bold, lightface and italic.

The Tektronix unit is an 11 inch display tube, whereby a display of 8 1/2 x 11 may be presented on the screen. The resolution is about 47 lines per inch. Using the tube in the storage mode, an entire page would be swept on the tube. This would need to be done only once, and the image would remain until erased by the computer. Again, a camera could be set up under computer control, so that galley proof could be obtained rapidly.

It has not yet been determined whether the galley proofs obtained in this way would be consistently good enough to be sent to authors for proofreading.

III. COMPUTER DRIVEN MONOTYPE

During a trip to England, L. F. Buckland visited Clowes and Son, who do the composition for Mathematical Reviews, and the Monotype Corporation. The purpose was to discuss possible experiments that could be done to illustrate the use of computer driven monotype for mathematical typesetting.

Monotype is keyboarded onto a 31-channel tape which drives the monotype caster. The symbol codes on the tape correspond to symbols in the matrix case, which contains 225 symbols. Different matrix case layouts are used for different jobs.

A converter has been designed which converts 8-channel tape to 31-channel tape and it appears to be desirable to investigate the possibility of processing the bibliographic tapes produced by Mathematical Reviews (see Section A of this report) through a computer to produce a tape which could then be run through this converter.

In setting Mathematical Reviews, the printer keyboards and typesets headings of reviews and text of reviews in two separate runs, since different matrix cases are used. The matrix case for the headings contains bold, roman, and italic fonts, with accents, plus a few mathematical symbols. The matrix case used for text contains roman, italic, and Greek fonts, and more symbols than the heading case. If the bibliographic heading tapes can be computer-processed to prepare a tape which contains the necessary typographic instructions and which can be converted into the Monotype tape, the keyboarding by the printer of review headings can be eliminated, and the proofreading and typesetting of the headings can be obtained automatically as a by-product of the Mathematical Reviews Office Mechanization.

III. 1. Double running of Monophoto. A second technique, brand new and proprietary with Clowes, is the running of a Monophoto twice using two matrix cases. The first run

leaves blanks for those characters on the second matrix. After the first run the film is backed up to the starting point. The second run leaves blanks where the characters have already been exposed by the first run. The total number of characters produced this way is approximately 900. In addition, superior and inferior are offset optically from a small font, not by reducing the lens size as is done in Photon operation. We have not considered the possible applications of our system to this method of composition.

IV. COLD TYPE COMPOSITION

There are a number of tape driven typewriters available which produce copy in a two-dimensional form which might be used for galley proof. Among these are the Dura with reverse platen keys, the Walter Reed Army Chemical Typewriter, and the National Bureau of Standards' Taxyriter. This latter device was investigated thoroughly.

IV. 1. Typeface Augmented x-y Recording Typewriter, the Taxyriter consists of an SCM Typetronic 2816 that has been modified to allow for typits to be inserted in their usual position in front of the platen. The typits themselves have eight holes machined in the side - four on one side and four on the other. This gives seven bits of typit code plus parity, allowing an augmented keyboard of 128 additional characters. Each typit has a number assigned that is embossed on its handle. The typits sit in a plastic case beside the typewriter. A block diagram of the TAXYRITER system is given in Figure 1.

The purpose of the TAXYRITER is to provide the working scientist with typewriter copy of a technical manuscript that can be proofread easily. The developers intended this primarily as an in-house operation where the end product would be a typed report.

Reading a tape back through the device is a slow process because the typing stops every time a typit is required. Instead it is intended that the system will employ a line printer with a print chain generally corresponding to the typit plus keyboard character set. All tape that is produced by the TAXYRITER must be processed by a computer before it can be played back through the device, or through a printer. This is because the code must be linearized (i.e. the playback must be in sequence from upper left to lower right on a page). The device can punch x-y position codes into the tape when the keying is done, but there is no mechanism for these codes to activate when the tape is played back. That is, the y codes are obtained from a shaft encoder when the keying is done.

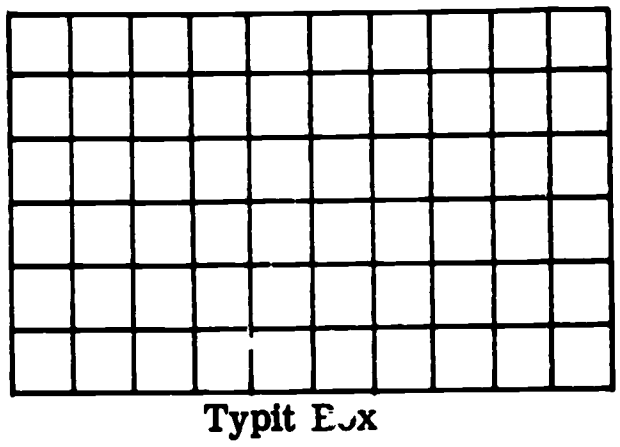
In addition to the keyboard, reader, punch, shaft encoder, and x position encoder, there are three control switches: typit mode input, typit mode output, and x-y mode output.

The function of the typit input mode switch is to stop the reading of tape when a typit code comes along. Indicator lights are lit on the switch box to indicate which typit is required. The operator inserts this typit, strikes a key, removes the typit, and depresses the resume read switch on the SCM.

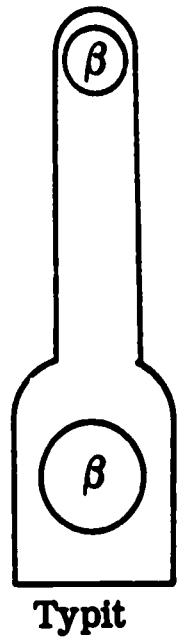
The typit mode output switch allows the user to insert typits at will when keying text. When a typit is inserted, the normal keyboard decoders are shorted out, and the code is taken from the typit contacts instead. This allows the user to insert the typit and strike any key on the keyboard.

The x-y mode output switch allows the user to roll the carriage and advance a line. When the next key is struck an x-y position is punched along with the character code. When in this mode there are four lines punched in the paper tape when a key is depressed: character, x, y, and block separator.

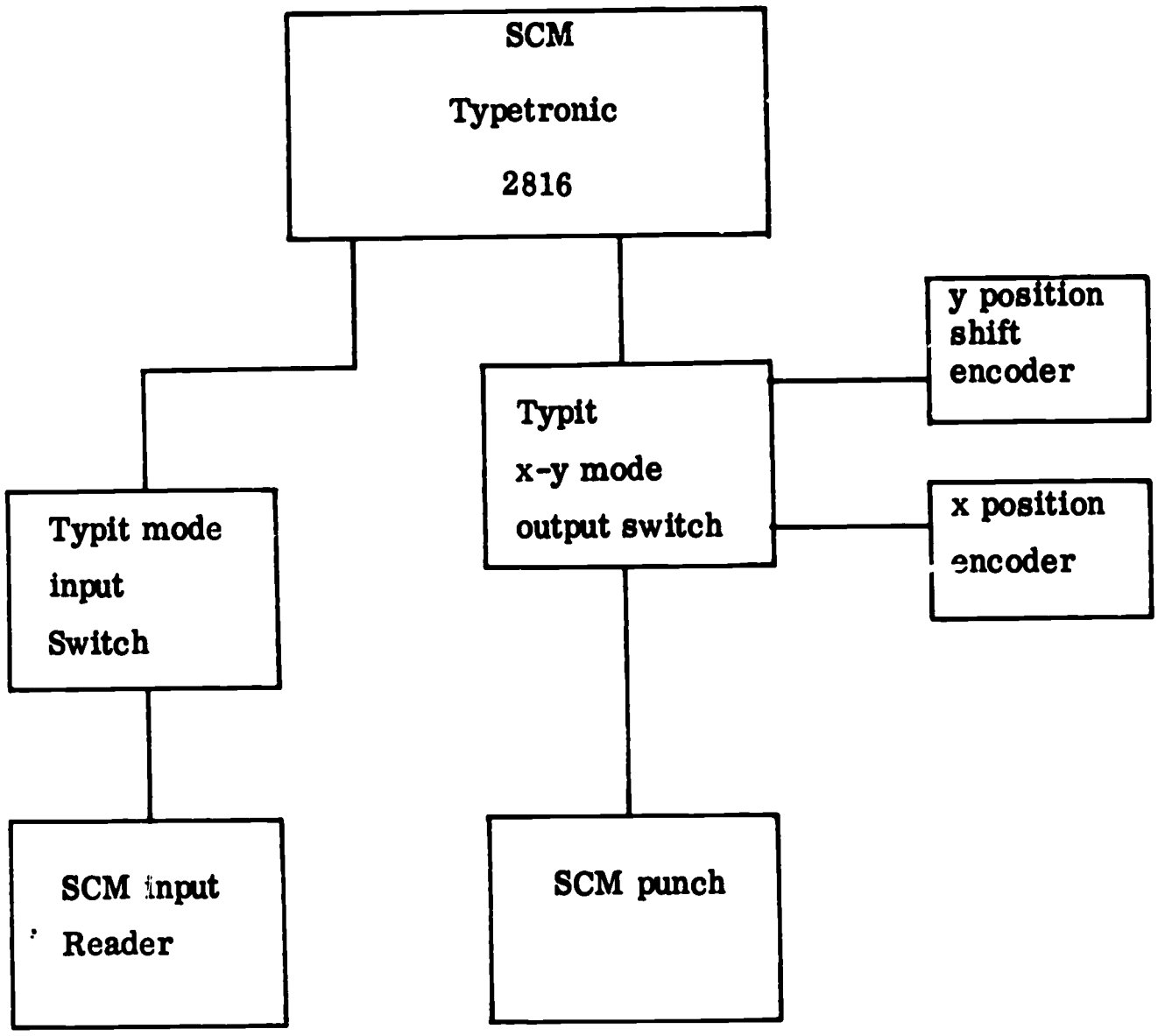
Figure 1. THE TAXYRITER SYSTEM



Typit Box



Typit



If the information that is keyed involves subscripts and superscripts, the tape must be run through a computer to be reformatted into top to bottom, left to right order. This is because there are no vertical platen control keys on the SCM. When this new tape is read back through the TAXYRITER we get the copy as in Figure 2. This was produced with grid control lines to facilitate editing with the computer. As this is being listed, when a typit is needed, the reading stops and the typit number is illuminated on the switch bc^. The operator inserts the proper typit, strikes any key, removes the typit, and continues the tape reading. This can be a very slow process if there are many typits. By using a tape control key on the SCM, the grid lines can be suppressed. Also, when the reading stops for a typit, the operator may simply strike a standard key, say the ◊, and the process continues. A sample of this operation is given in Figure 3.

IV.2. The Klerer-May system. Another two-dimensional input method has been devised by Melvin Klerer and Jack May. This input is made on a modified Flexowriter, with the platen revolved by keyboard control. The typing and language rules are quite flexible. This input has not been designed for typesetting, but for computer analysis of well-formulated problems.

Remarks. The American Mathematical Society has preferred to use an input language which does not require the use of highly specialized input machines. The proofreaders in our office find the linear input in the two-column format as easy to proofread as the two-dimensional typewriter input, and the two-dimensional input would not be satisfactory for galleys to be proofread by authors.

V. FACSIMILE SYSTEMS FOR GALLEY PROOF

V.1. Xerox via U. S. Mail. A form of facsimile transmission that is satisfactory for many purposes and the form that will invariably be cheapest is conventional Xerox copies sent via the U.S. mail. At 2 cents per page for the copies, 10 cents per ounce for air mail (approximately 6 pages), 4 cents for an envelope, and possibly an additional 35 cents for Special Delivery, the cost of the best mail facsimile service will be about 10 cents per page, even with very small volume. The speed, however, is the problem. Delivery time can be up to 2 days each way, extending the 3 transmission cycle time of a galley proof to as much as 1 week.

Hence, there is strong reason to want to substitute faster facsimile systems for mail services. Two of the most recent telefacsimile systems were examined briefly, the Xerox LDX system and the Xerox-Magnavox Telecopier, and as we shall explain below, neither one appears suitable for our application at this time. Their respective problems, in brief, are high cost and low resolution.

V.2. Xerox LDX system. The LDX (Long Distance Xeroxgraphy) system consists of a high speed CRT scanner which is coupled to a broadband transmission channel and thence to a xeroxgraphic printer. It leases for about $800 per month, can deliver 8.7 8 1/2 x 11 pages per minute, and has a resolution option of 135 or 190 lines per inch (≈7.5 lines/mm. max.) It requires a wide band microwave or telephone channel between stations, approximately 100 times the bandwidth of a voice grade circuit; 240k. Hz is typical. It would require a high volume of use to justify in any application, and the high bandwidth requirements (with attendant high costs) would probably preclude any real long distance application. Two sets of typical users of LDX are 2 and 50 miles apart, respectively.

No examples of LDX transmissions were available for inspection, but their claimed

Figure 2.

Play back of TAXYRITER Copy.

Typits inserted. Grid lines present.

```
Page Block No.   2
  Y   Flags  Lines  P+++5+++10+++15+++20+++25+++30+++35+++40+++45+++P
                  1       Now is the time, indeed, it is well past
                  2  time that we should be routinely capturing,
                  3  and processing scientific records which contain
                  4  lines like the following:
                  5       Δμ_i = V_i ΔP + θ_i log m_i^c/m_i^α
                  6       Symbols like V_i, ẋ_i^2, and [∂H/∂T]_P can be
                  7  handled without torment if we are willing to do
                  8  the necessary jobs of analysis and design.
                  9       One can have more, e.g., composite symbols:
                 10  Å, é, ŏ, Ø, ç, and ←.
Book Block No.   1
```

Now is the time, indeed, it is well past time that we should be routinely capturing and processing scientific records which contain lines like the following:

$$\Diamond\Diamond_i = V_i \Diamond P + \Diamond_i \log m_i^{\Diamond}/m_i^{\Diamond}$$

Symbols like $\overset{\Diamond}{V}_i$, $\overset{\Diamond}{x}_i^2$, and $\Diamond\Diamond H/\Diamond T\Diamond_p$ can be handled without torment <u>if</u> we are willing to do the necessary jobs of analysis and design.

One can have more, e.g., composite symbols: ♣, ♠, ♂, Ø, ♀, and ♦.

Figure 3.

Play back of TAXYRITER Copy.

A ◊ is struck every time a typit is needed. Grid lines suppressed.

resolution might very well be sufficient for the 6 point superscripts which would present the greatest problem in lower resolution systems. But resolution figures say little about noise, signal distortion, poor contrast and other unmeasured sources of fuzzy typography.

LDX may be transmitted via coaxial cable, microwave, or via telpac. 240k. Hz Telpac C lines cost $25 per mile per month, and transmission can take place at a slower rate on a 48k. Hz Telpac A line at an approximate cost of $15 per mile per month. For the 600 mile span considered Ann Arbor to Providence, and the 600 transmissions per month, communications cost would be a staggering $15,000 or $9,000 per month, equivalent to $25 per page, respectively. The additional costs of the LDX machines, communications modems, clerical labor, and supplies would increase this cost 35% or so, but it is seen that the line charges alone are prohibitive for the application intended. Using a wideband channel at about 5% capacity, as in this case, will invariably be uneconomic. Short term lease of wider bandwidth video lines (coax or microwave) offer no greater economies. At a rental of about $1.15 per mile per hour, and a use of one hour per working day, the Providence - Ann Arbor toll would still exceed $15,000 per month.

V.3. Xerox Magnavox Telecopier. This machine has a resolution of 96 lines per unit (3.78 1/mm) about half the resolution of the LDX. It leases for a minimum of fifty dollars per month per machine, and uses a conventional voice grade circuit. A standard 8 1/2 x 11 inch page can be sent in 6 minutes. At 80 pages per day maximum it should be sufficient for galley transmission in a publishing application requiring 600 transmissions per month, or about 27 pages per day average. In this case the line is used at somewhat better than 1/3 capacity, and the transmission economics are more favorable. Interstate line costs are based on a sliding scale from $3.00 to $1.05 per additional mile per month. Communications costs would be about $795 per month, or $1.33 per transmission for a leased line. This is about half the cost of 600 7-minute calls on a toll basis.

Line charges are still the dominant factor, making up about 47.5% of the total monthly charges estimated to be $1676 in all, or $2.79 per page.

The main problem, however, is the quality, which in this writer's judgement with respect to the intended application, is grossly deficient. The page examples in the Morehouse report, which shown in fairness, that even 4 point type is faintly legible; also show that even 10 and 12 point type is distinctly unpleasant to read. For purposes of accurate proofreading the quality must be almost as good as the final printing, and there must never be doubt as to whether a letter is "e" or "c". Language redundancy makes most transmitted copy certainly readable, but just as certainly not proofreadable.

V.4. Other systems. Facsimile systems are produced by many manufacturers, but most appear to suffer the same limitations as the two Xerox systems considered here: high communications cost and/or low resolution. Litton's Pressfax system, for example, is said to resolve up to 1000 lines per inch, but it, like LDX, requires an expensive video channel or high cost Telpak line. Several other systems, like the Telecopier, share resolutions of 96 lines/inch and transmissions via voice grade phone line. By way of resolution comparison, a well tuned Xerox 940 office copier will deliver 5th generation copies with resolutions in the range of 250 to 350 lines per inch.

An experiment was conducted in which a video test chart and a page of Mathematical Reviews were run through 9 succesive generations on a Xerox 940 in order to degrade the resolution to a known set of points. The resolutions of the successive test charts were then used to obtain a qualitative estimate of the page quality at corresponding resolutions. These tests indicated that a resolution in the order of 300 lines per inch is needed for acceptable proofreadable copy. The experimental copies themselves are included in copy 1 of this report sent by Inforonics to the American Mathematical Society. The results are summarized in Figure 4. Typical 5th generation copies of page and test chart are included as figures 5

FIGURE 4

Resolution Tests

Generation of Copy (original = 0)	Indicated Resolution	Proofreading Quality
3	Greater than 1000 video lines in center = 356 optical lines	good
4	≈850 video lines in center = 300 optical lines	acceptable
5	≈750 video lines in center = 266 optical lines	marginal
7	≈500 video lines in center = 178 optical lines	poor
9	≈400 video lines in center = 142 optical lines	worse

Note: We use the usual conversion factor of 2.8 video lines (roster lines) to 1 optical line (black and white line pair), which includes the Kell factor of 1-4 that corrects for the inexact correspondence of roster lines and line pair. For a non-scanned video chart, a conversion factor of 2 would be more appropriate. The difference insures that our estimated minimum resolution requirements are conservatively low.

Figure 5.

Pour $s>0$ non entier on dira que $u \in W_p^{(s,s)}(\Omega)$ si $u \in W_p^{([s],[s])}(\Omega)$, où $[s]$ est le plus grand entier $\leq s$, et si de plus

$$M = \sup_{\substack{x_0,y_0 \in \Omega \\ 0<\theta\leq\theta_0}} \frac{1}{\theta^\lambda} \sum_{|\nu|=[s]} \int_{K(x_0,\theta)\cap\Omega} dx \times \int_{K(x_0,\theta)\cap\Omega} \frac{|D^\nu u(x) - D^\nu u(y)|^q}{|x-y|^{n+q(s-[s])}} dy < \infty.$$

On munit $W_p^{(s,s)}(\Omega)$ de la norme $\|u\|_{s,q,\lambda} = (\|u\|^q_{[s],q,\lambda} + M^q)^{1/q}$. Supposons que Ω possède la propriété du cône et que $q>1$. Si $u \in W_p^{(s,s)}(\Omega)$, où $0<s<1$, $0 \leq \lambda \leq n-sq$, alors $u \in L^{(\mu,\mu)}(\Omega)$ pour tout $0 \leq \mu < qs+1$ et l'on a $\|u\|_{0,q,\mu} \leq c\|u\|_{s,q,\lambda}$. Si $u \in W_p^{(s,s)}(\Omega)$, où $s>1$ non entier, $0 \leq \lambda \leq n-\theta q$, $\theta = s-[s]$, alors: (i) si $0 \leq \lambda \leq n-sq$, on a $u \in L^{(\beta,\nu)}(\Omega)$ pour tout $\beta<\beta^*$ et $\nu<n+q\beta-\beta n/q+\beta\lambda/q$, où $\beta^* = q(n-\theta q-\lambda)/(n-sq-\lambda)$ si $\lambda<n-sq$ et $\beta^*=\infty$ si $\lambda=n-sq$, où l'on a $\|u\|_{0,q,\nu} \leq c\|u\|_{s,q,\lambda}$, (ii) si $n-sq<\lambda\leq n-\theta q$, alors u est égale presque partout à une fonction continue et bornée dans Ω qui vérifie $\sup_\Omega |u(x)| \leq c\|u\|_{s,q,\lambda}$. Si de plus la frontière de Ω est localement lipschitzienne, alors $|u(x)-u(y)| \leq c\|u\|_{s,q,\lambda}|x-y|^\alpha$ pour tout $x, y \in \Omega$, où $\alpha<s+\lambda/q-n/q$ si $n-sq<\lambda\leq n-(s-1)q$ et $\alpha=1$ si $n-(s-1)q<\lambda\leq n-\theta q$.

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Zur praktischen Bestimmung nichtlinear auftretender Eigenwerte. Anwendung des Verfahrens auf eine Stabilitätsuntersuchung (Kipperscheinung).

Z. Angew. Math. Mech. 40 (1960), 136–143.

The authors consider eigenvalue problems of the form

$$(M) \qquad \varphi = K_0\varphi + \lambda K_1\varphi + \cdots + \lambda^k K_k\varphi,$$

where φ belongs to a separable Hilbert space H, while $K_0, K_1, \cdots, K_k$ are completely continuous linear operators mapping H into H; λ is the wanted eigenvalue. Such problems are related to phenomena of instability in elastomechanics; in particular, the case $k=2$ occurs in the theory of lateral buckling of beams. With the aid of a complete orthonormal system $\{\varphi_i\}$ the problem is translated into one for the Fourier components of φ, i.e.,

$$v = A_0 v + \lambda A_1 v + \cdots + \lambda^k A_k v,$$

where v is the vector of the Fourier components in l^2, and where the A_i represent completely continuous transformation matrices of the l^2. The approximating problem

$$(M_n) \qquad x = A_0^{(n)}x + \mu A_1^{(n)}x + \cdots + \mu^k A_k^{(n)}x$$

is introduced, where $A_i^{(n)}$ is the finite $n \times n$ segment of the matrix A_i; x is now a vector of n components.

The authors show that the eigenvalues of (M) are accumulation points of the eigenvalues of the problems (M_n) for $n=1, 2, \cdots$ provided that $\lambda=0$ is not an eigenvalue. Their proof is based on the well-known possibility of reformulating the problems with the aid of the k-fold product space, e.g., $l^2 \times l^2 \times \cdots \times l^2$, whereupon a linear appearance of λ can be obtained. From here on results from the perturbation theory of linear operators can be utilized.

A numerical example concerning the Prandtl problem of lateral buckling of a beam is presented. The authors point out that the method (M_n) has certain advantages over the original treatment by Prandtl.

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Sull'integrazione delle funzioni $l^p\{X_n\}$-quasi-periodiche, con $1 \leq p < +\infty$.

Ricerche Mat. 12 (1963), 3–12.

Soit $\{X_n\}$ $(n=1, 2, \cdots)$ une suite d'espaces de Banach, on appelle $X=l^p(X_n)$ $(1 \leq p < +\infty)$ l'espace de Banach dont les éléments sont de la forme $x=\langle x_1, x_2, \cdots\rangle$, avec $x_n \in X_n$, et $|x| = (\sum_1^\infty |x_n|^p)^{1/p} < +\infty$; alors si, pour tout n, le fait que $x_n = f_n(t)$ est presque-périodique dans X_n et que la fonction $F_n(t) = \int_0^t f_n(u)\,du$ est bornée, entraîne que $F_n(t)$ est presque-périodique, le même résultat vaut dans X, c'est-à-dire, que si $x=f(t)$ est presque-périodique et si $F(t)=\int_0^t f(u)\,du$ est bornée, elle est aussi presque-périodique.

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Soluzioni quasi-periodiche di equazioni quasi-periodiche negli spazi hilbertiani.

Ann. Mat. Pura Appl. (4) 61 (1963), 259–277.

Soient Y et X deux espaces hilbertiens, avec X $(\subseteq Y)$ séparable, dense dans Y, l'immersion étant continue (d'où $|x|_Y \leq \nu|x|_X$, où ν est la constante d'immersion); $a(t, u, v)$, $b(t, u, v)$, $c(t, u, v)$, $d(t, u, v)$ quatre formes bilinéaires et continues en $\langle u, v\rangle$, dépendant du paramètre t $(-\infty<t<+\infty)$ et définies sur $X \times X$, $Y \times X$, $X \times Y$, $Y \times Y$ respectivement. On dit qu'une fonction $g(t) \in L^2(\Delta, X)$ si, sur tout segment Δ de $-\infty<t<+\infty$, elle est définie presque-partout, sommable et de carré sommable; on pose une définition analogue pour $g(t) \in L^2(\Delta, Y)$. On considère l'équation:

$$\int_{-\infty}^{+\infty} [(x', h')_Y - a(t, x, h)]\,dt = \int_{-\infty}^{+\infty} [b(t, x', h) + c(t, x, h) + d(t, x', h) + (f, h)_Y]\,dt$$

où $x, x', h, h', f,$ sont à remplacer par $x(t), \cdots, f(t)$ respectivement, où $f \in L^2(\Delta, Y)$ est une fonction donnée, où $x(t)$ est l'inconnue, avec $x \in L^2(\Delta, X)$, $x' \in L^2(\Delta, Y)$ et où $h(t)$ décrit l'ensemble des fonctions à support compact, telles que $h \in L^2(\Delta, X)$, $h' \in L^2(\Delta, Y)$. Le but du travail est de démontrer, avec des hypothèses convenables, un théorème de compacité et, lorsque $f(t)$ est presque-périodique dans un sens précisé, de démontrer l'existence d'une solution presque-périodique dans le même sens.

Parmi ces hypothèses nous noterons la condition que l'immersion de X dans Y est complètement continue, et la condition d'ellipticité: $\mathcal{R}a(t, x, x) \geq m|x|_X^2$ $(m>0)$; avec des hypothèses sur les bornes et la continuité uniforme des opérateurs définis par les formes a, b, c, d, on emploie alors la méthode du minimax, utilisé par le rapporteur dans un cas simple, pour démontrer le résultat sur la presque-periodicité.

Le résultat général est appliqué ensuite aux équations aux dérivées partielles linéaires du second ordre, hyperboliques, dont les coefficients dépendent à la fois du temps et des points de l'espace des phases (à un nombre fini de dimensions); on obtient un résultat analogue.

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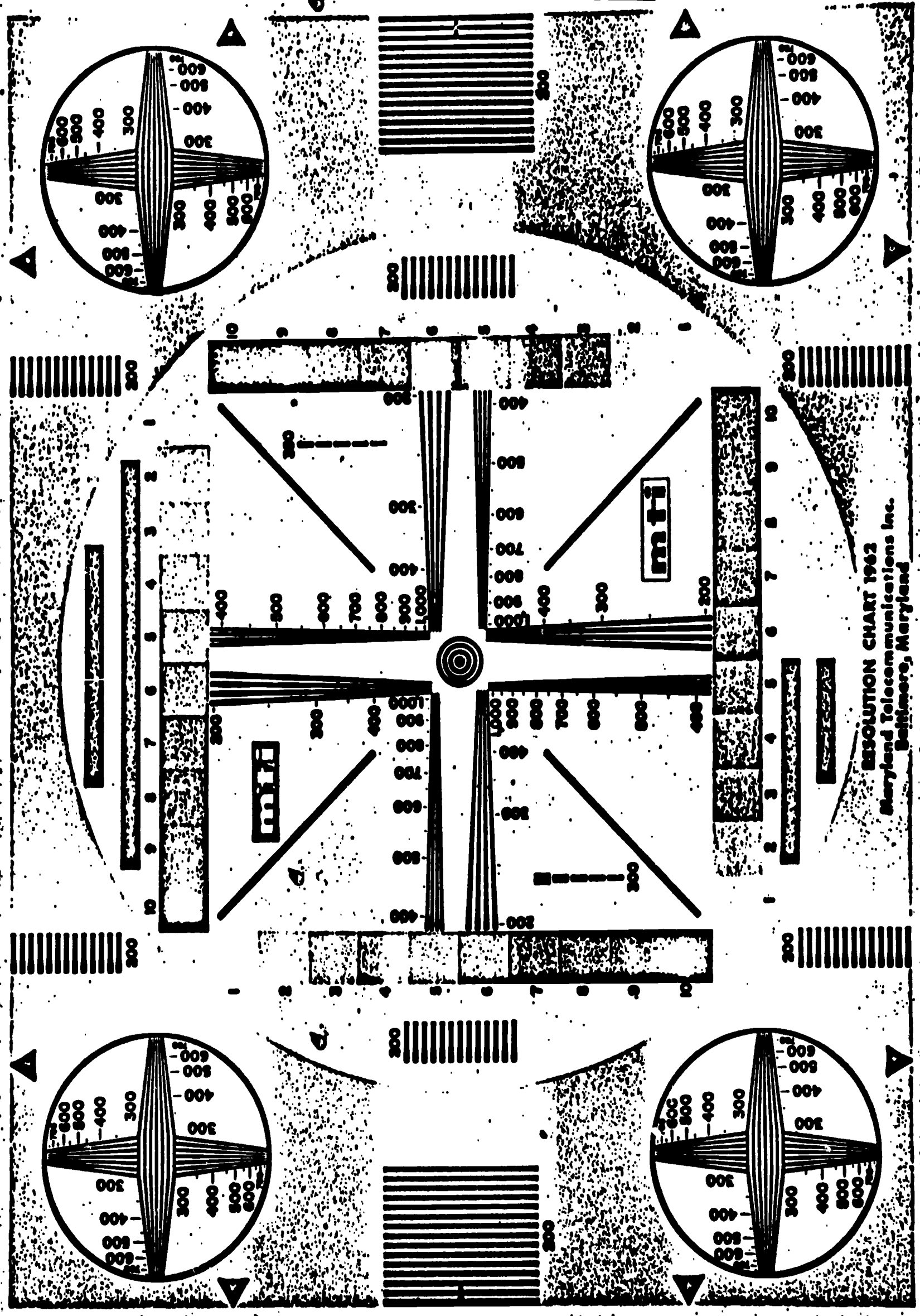
Šilov, G. E. 6161

Integration in infinite-dimensional spaces and the Wiener integral. (Russian)

Uspehi Mat. Nauk 18 (1963), no. 2 (110), 99–120.

FIGURE 6

Video Resolution Chart-5th Generation Xerox



and 6. This Xerox test is only an approximate estimate of required resolution, since the resolution is not uniform across the page, repeated tests do not provide precisely repeatable results, and noise is introduced that complicates the resolution reading. This test would yield more accurate results using one pass copying via calibrated optical defocussing. But as a first approximation our test result seems reasonable, since the facsimile systems themselves have noise. On a noise free system a resolution perhaps 20% less (≈240 lines per inch) could be tolerated.

A new low-cost facsimile device, which will soon be marketed by the Shintron Company of Cambridge, Massachusetts, has been brought to our attention. Preliminary information indicates that the device may be in the under $500 category for each transmitter or receiver. The units will connect directly to the bandset of a normal telephone, avoiding the usual telephone company interface charges. It is said to be insensitive to normal room noise because of frequency modulation of the carrier. Resolution figures are not yet available, but transmission time is reported to be about 8 minutes.

VI. OTHER INPUT SYSTEMS

VI.1. Mathset. Mr. R. D. Freeman of the Bell Telephone Laboratories has developed a computer program for the automatic typesetting of mathematical formulas. The program was written to accept input from an ordinary teletype or similar device. The output of the program will be demonstrated by means of mathematical expressions printed in a domonstration character set on the Stromberg-Carlson SC-4020 microfilm plotter. In discussions with Mr. Freeman, he has indicated that the thinking behind the input language is similar to that developed by the American Mathematical Society, the two-column format, although the actual tags used were different.

VI.2. Flag method. Vance Weaver Composition, Inc. has devised a method for the machine-recording of physics data. This is a modification of the STIL language described on page 5 of section B of this report. In the flag system, dead-key (no escapement) selectors and modifiers are used to flag hardcopy characters without stringing them out on hardcopy. Flags are used above (to indicate which set of characters the selection is to be made from) and below (to indicate type fonts such as italic or bold, or positions such as superior and inferior. The dead-key characters selected were an overdot (Greek), overbar (mathematical symbols), double overdot (san-serif), acute accent (Script), underline (italic) wavy underline (bold), under caret (superio-), under inverted caret (inferior). Thus an alpha would be coded as a, an italic lowercase a as a, an italic a superscript as a, a bold italic inferior a as a. Tests of this system as compared with the input system using the escape key showed much the same results as our tests comparing the two-column input with the escape key input, namely that both keyboarding time and proofreading time is greater with the escape key input. However, since mathematical input, in particular bibliographic input, contains such a high percentage of accent marks, we feel that the flag input would be confusing for anything except English text.

VI.3. American Chemical Society. The American Chemical Society is now printing four journals on Photon, by use of computer-processed tape. Plans are now being made to cooperate with them in further work on the input language for mathematical typesetting.

VII. PROJECTED COMPOSITION COSTS

Although the programming for mathematical typesetting has not been done, it is possible to estimate the operating costs of typesetting, if the necessary programming has been done.

Computer charges		
Master file generation, including paper tape reading		
Tape reading	4.5¢/1000 char	
Master file generation	3.6¢/1000 char	8.1¢/1000 char
Proof copy line printer listing		2.5¢/1000 char
Edit Merge - first pass		6.0
Typesetting program, proof pass		25.0
Edit Merge - Second pass		6.0
Typesetter program, final		25.0
		72.6

Typesetting charges	
High-speed typesetter printout	
Proof pass	$1.50 per page
Final	4.50 per page
	$6.00
Photon	
Proof Pass	$1.00 per page
Final	1.00 per page
	$2.00 per page
Typing input	$3.00 per page
Page make-up	.75 per page

The composition costs for a 3000-character page such as the proceedings of the American Mathematical Society would be

	High-speed	Photon
Computer costs (3300 characters, assuming 10 percent corrections)	$2.40	$2.40
Typesetter printout	6.00	2.00
Input	3.00	3.00
Page Make-up	.75	.75
	$12.15	$8.15

The present cost of monotype composition for the Proceedings is $18.00 per page.

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